Louisiana Estuaries, Oysters and Freshwater Diversions

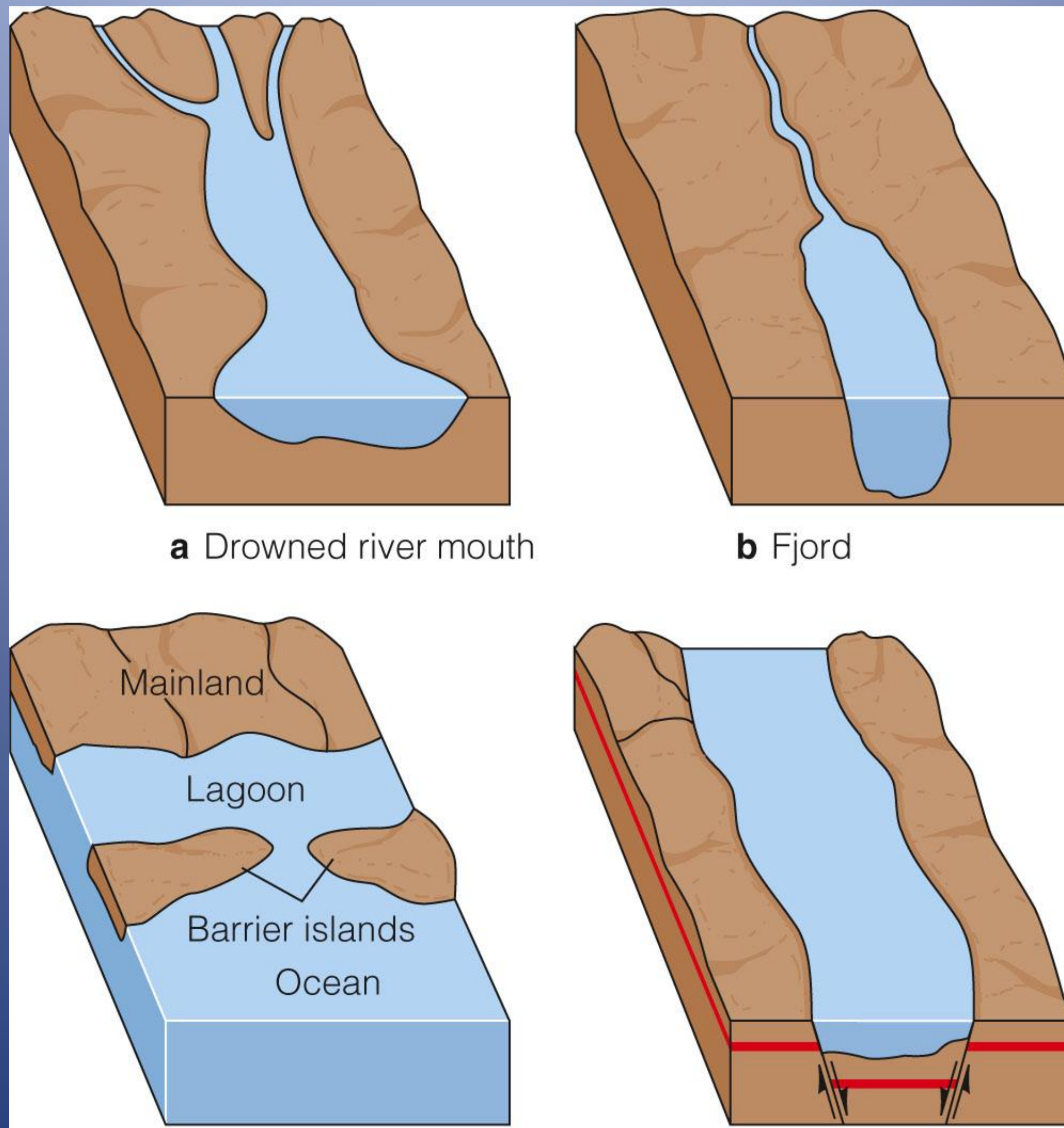
What does the future hold?

The question we must ask – “Which is worse: freshwater killing the oysters, or oil fouling the oyster beds?”

THE UNIVERSITY of NEW ORLEANS

Pontchartrain Institute for Environmental Sciences
University of New Orleans

Main Types of Estuaries – Which one is missing?



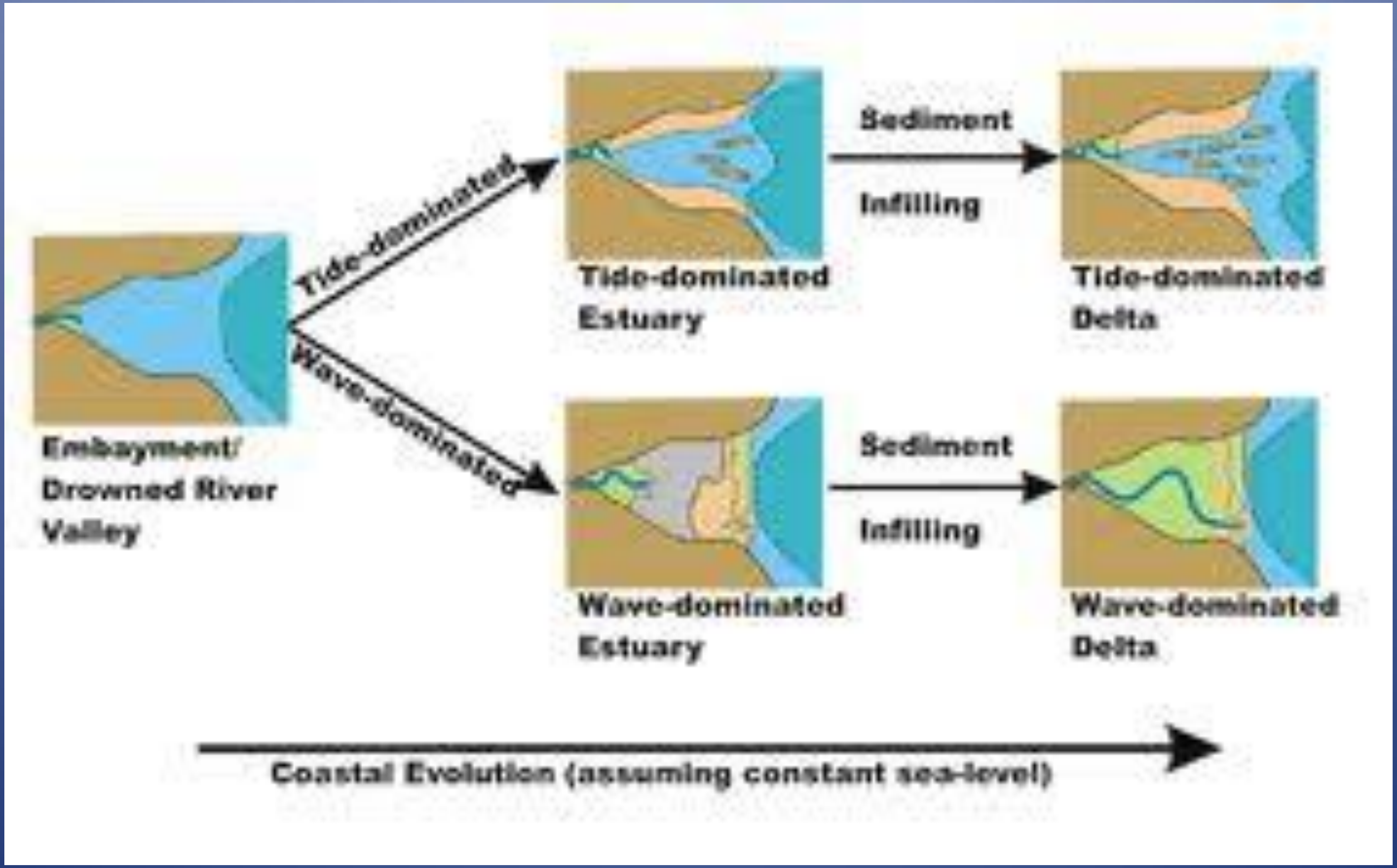
a Drowned river mouth

b Fjord

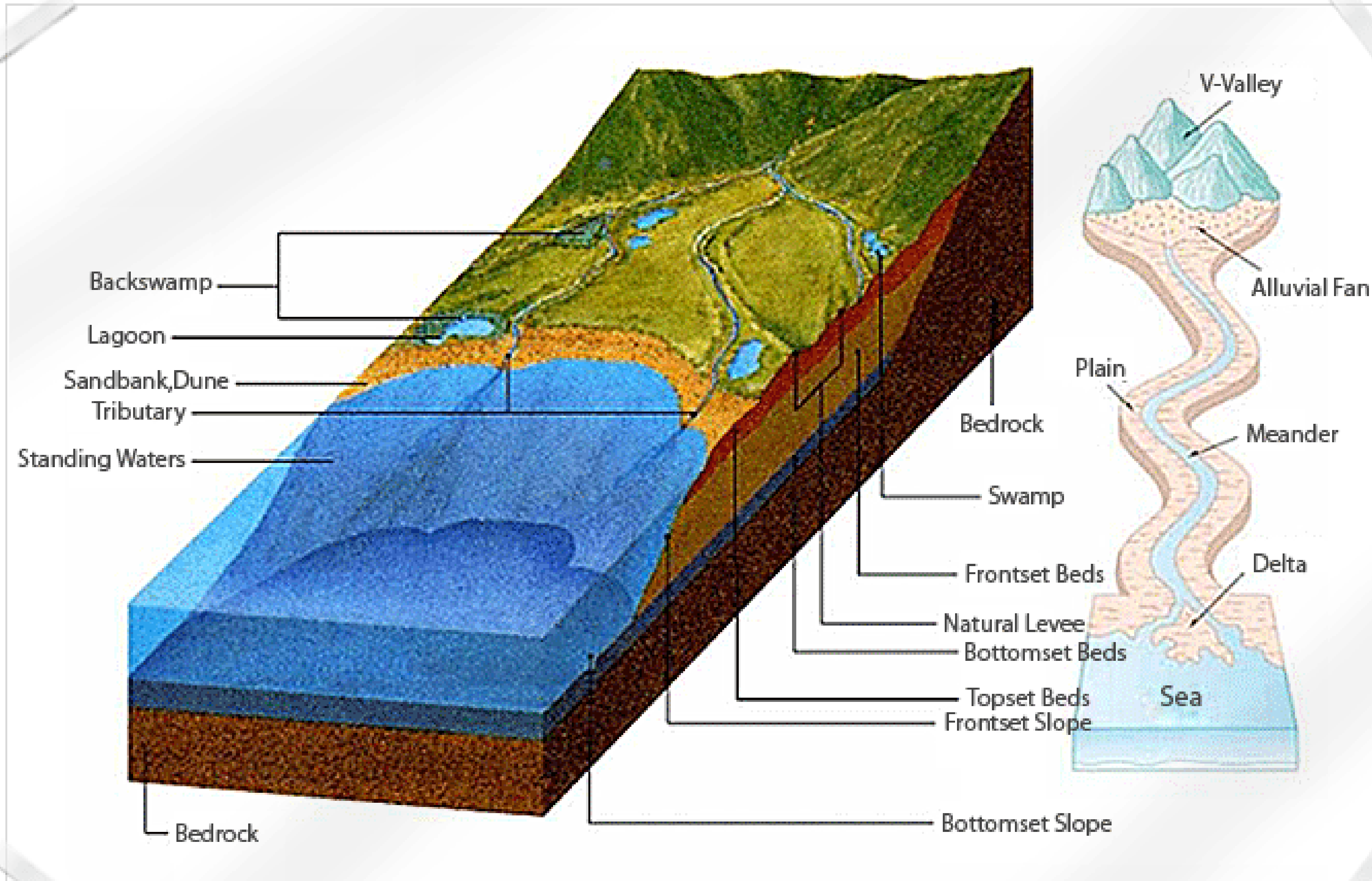
c Bar-built

d Tectonic

Formation of a Delta

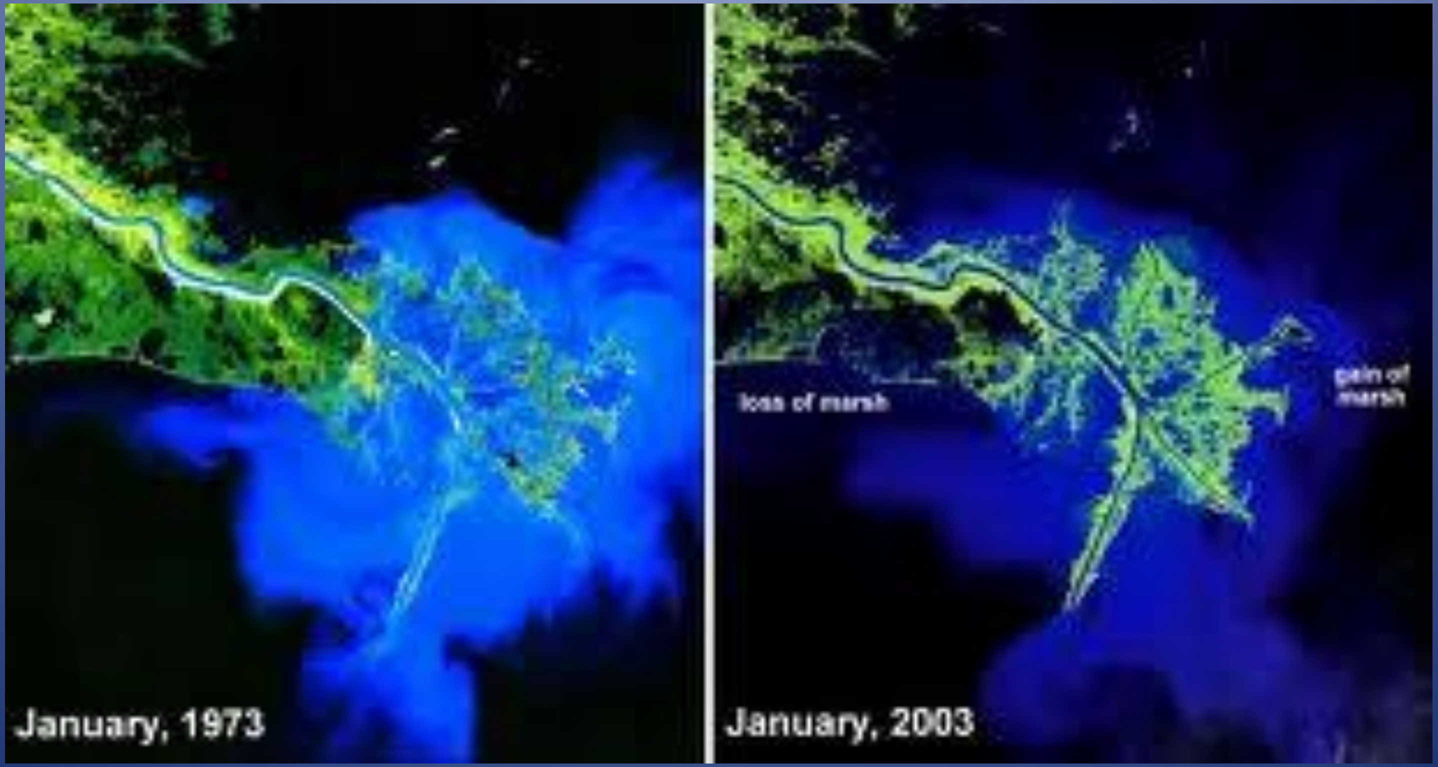


Delta estuary – example: Barataria Terrebonne Estuary



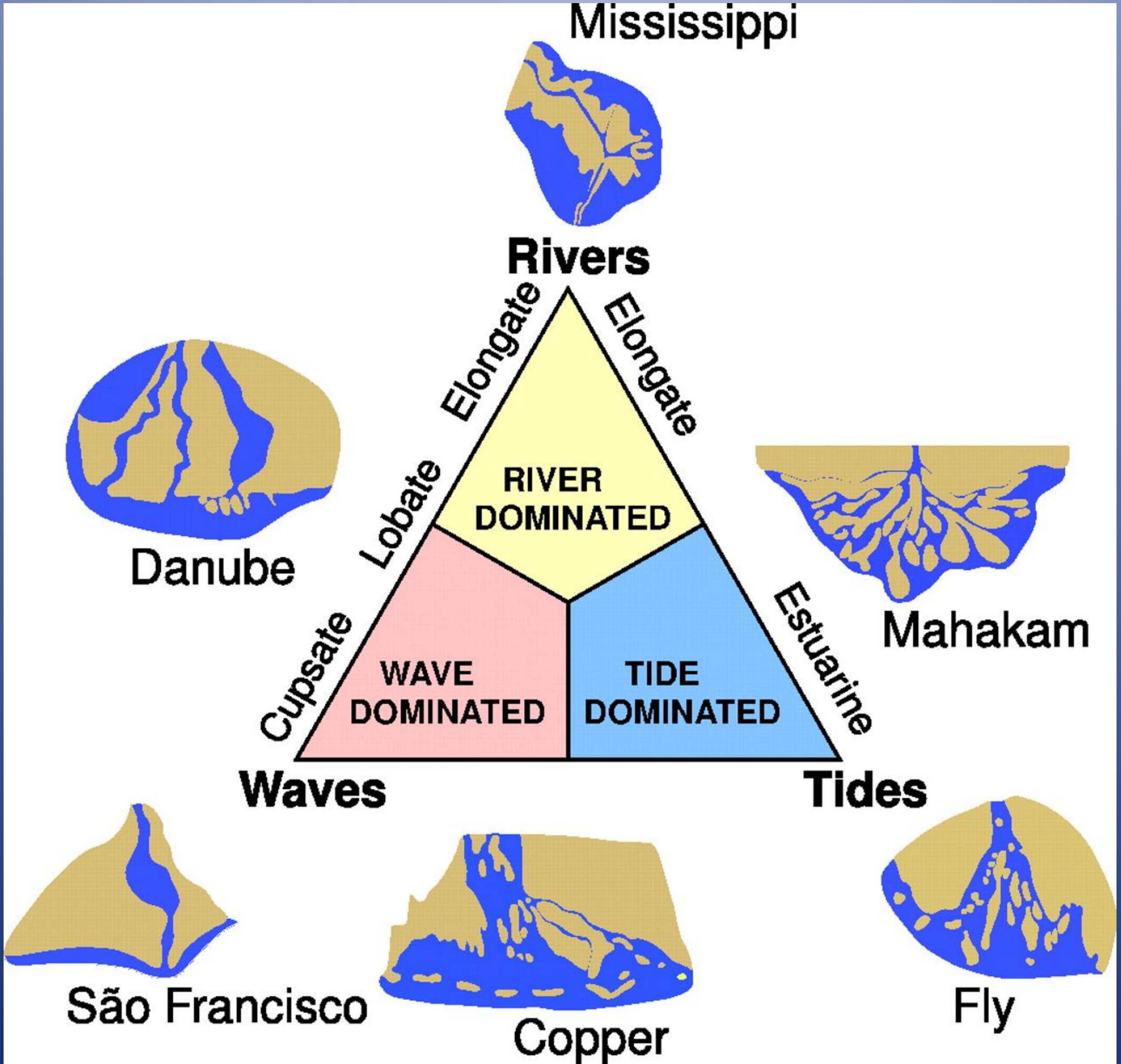
The “Modern” Birdsfoot Delta (Mississippi River)

Spot the differences



The Birdsfoot Delta

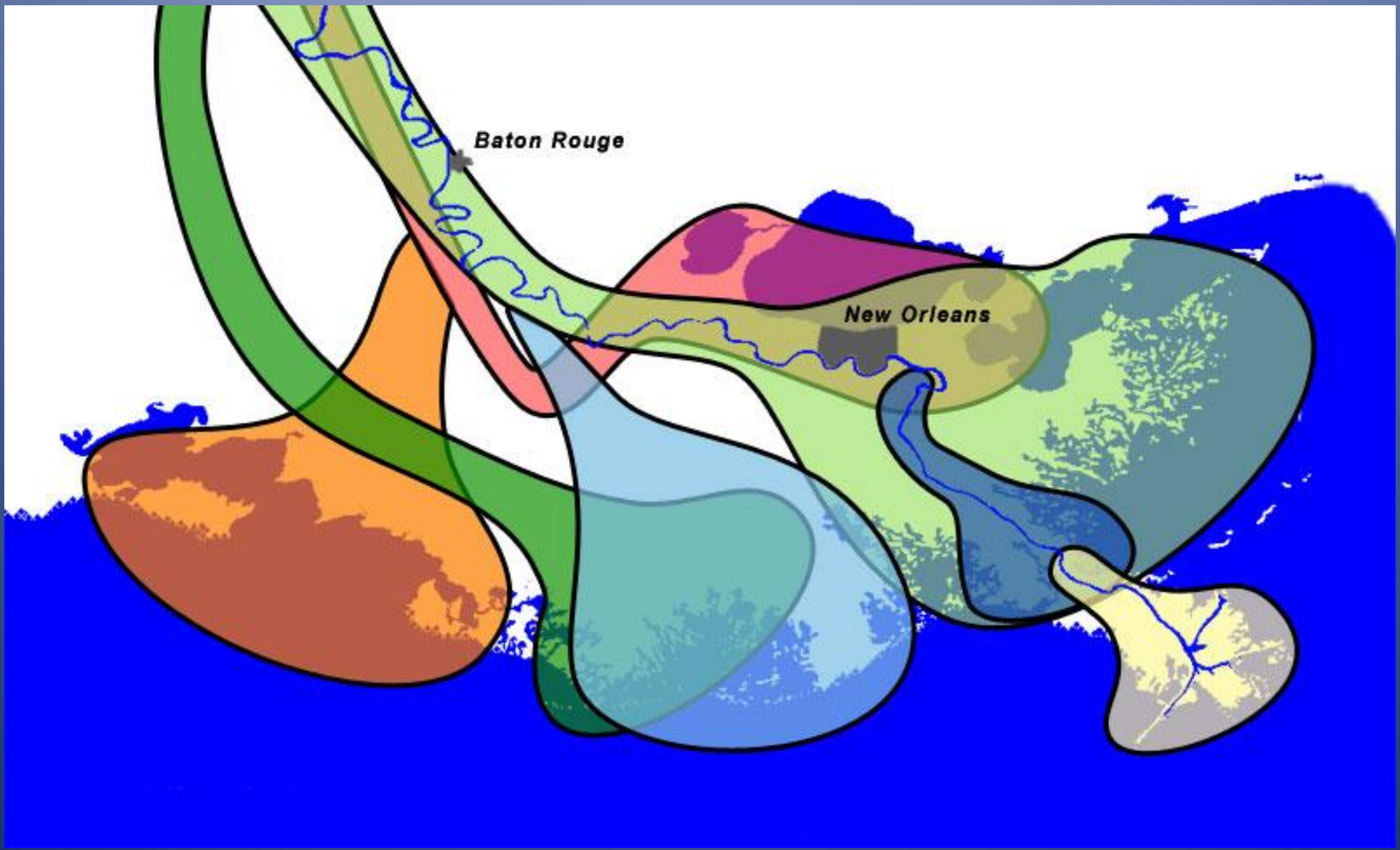
Delta Types

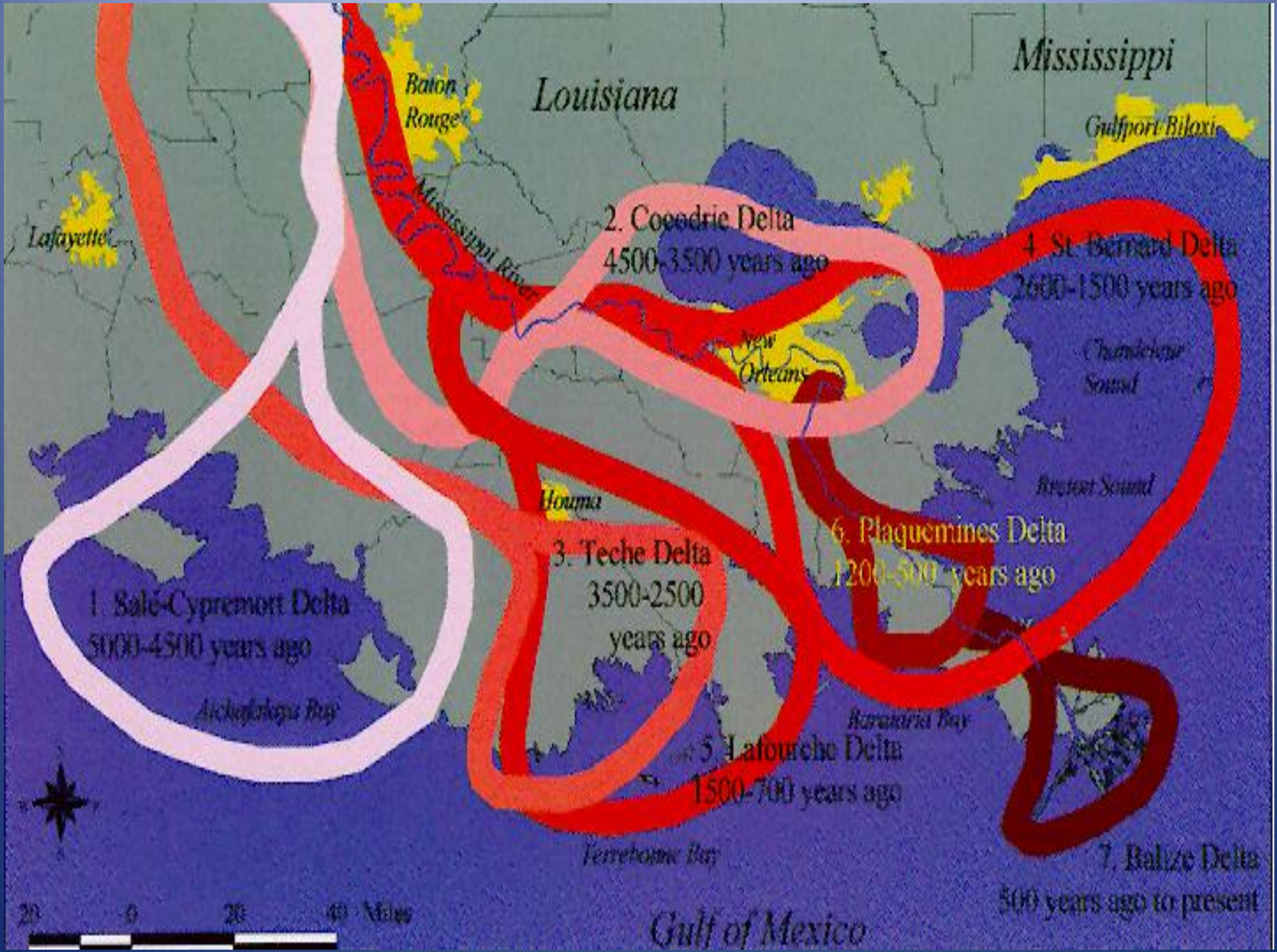


Mississippi
Rivers
Elongate
Elongate
RIVER DOMINATED
Lobate
Danube
Mahakam
Estuarine
Cupsate
WAVE DOMINATED
TIDE DOMINATED
Waves
Tides
São Francisco
Copper
Fly

The Past

About 7000 years of sediment deposition by the Mississippi River created a delta of 20,000 square miles.

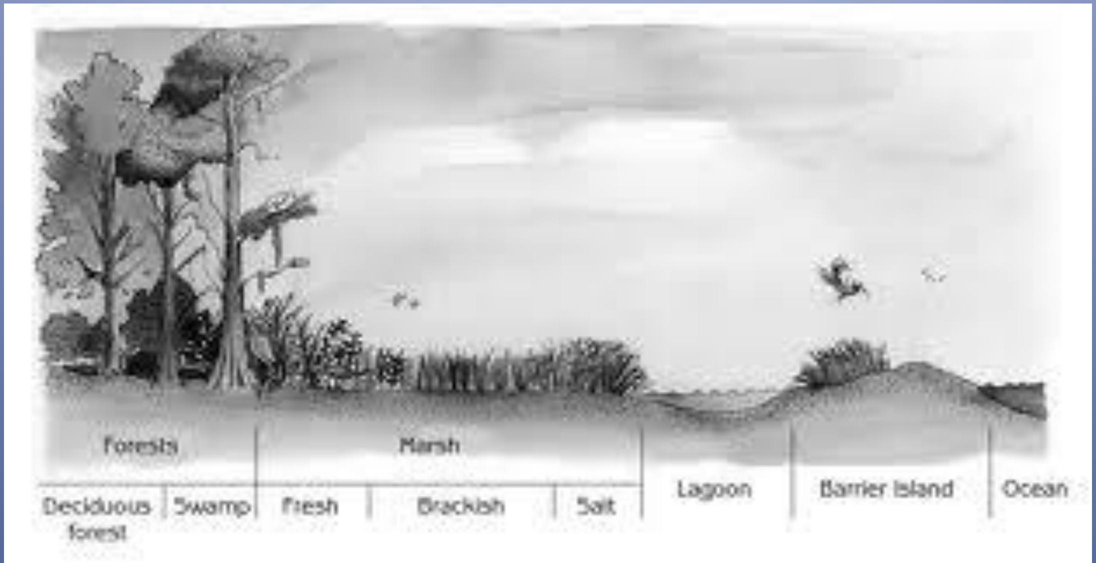




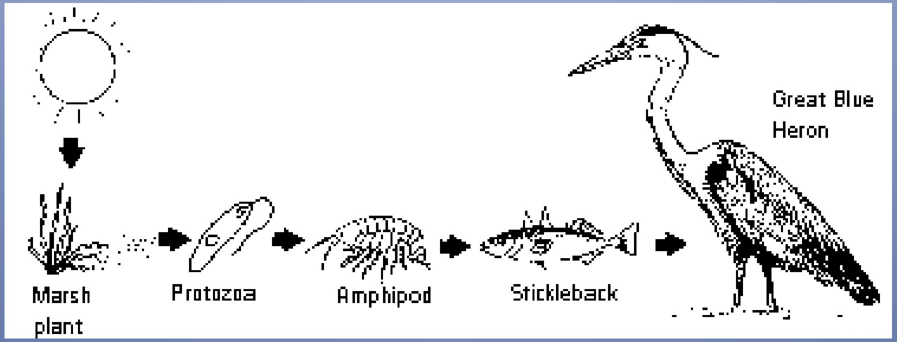
Mississippi
Louisiana
Baton Rouge
Gulfport Biloxi
Lafayette
Mississippi River
2. Cocodrie Delta
4500-3500 years ago
4. St. Bernard Delta
2600-1500 years ago
New Orleans
Chandeleur Sound
Breton Sound
Houma
6. Plaquemines Delta
1200-500 years ago
3. Teche Delta
3500-2500
years ago
1. Salé-Cypremort Delta
5000-4500 years ago
Atchafalaya Bay
Barataria Bay
5. Lafourche Delta
1500-700 years ago
Terrebonne Bay
7. Balize Delta
500 years ago to present
20 0 20 40 Miles
Gulf of Mexico


L O U I S I A N A
Mississippi River
Atchafalaya Bay
Mississippi "Bird Foot" Delta
GULF OF MEXICO
LSU
Earth Scan Laboratory
Coastal Studies Institute

Estuary Ecology



Estuaries are among the most biologically productive ecosystems on the planet and serve as nurseries for many aquatic species, providing an energy source for the young to grow in a sheltered environment.



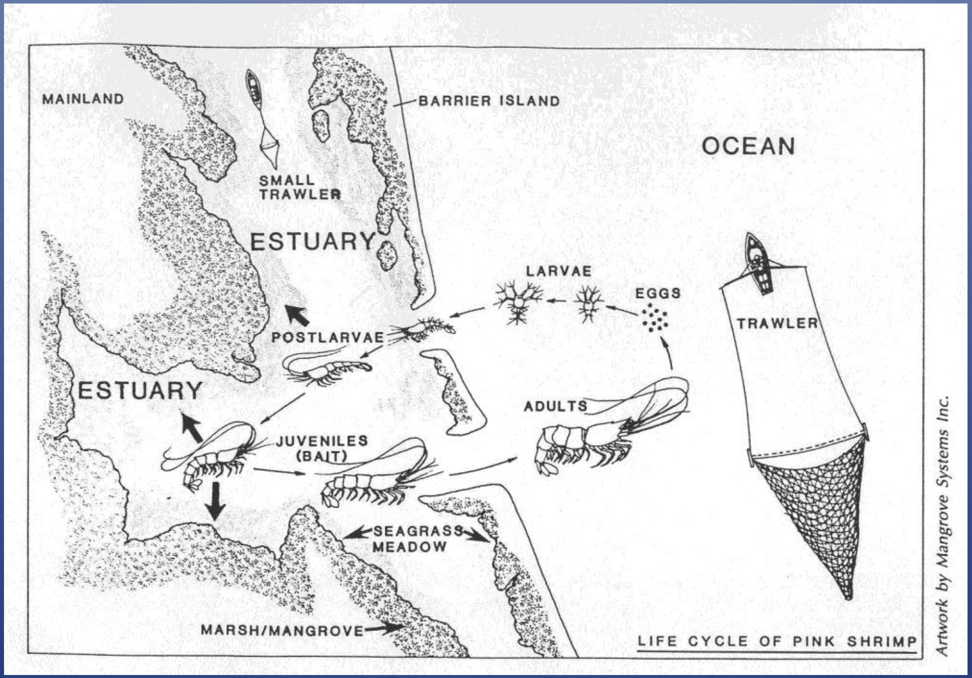
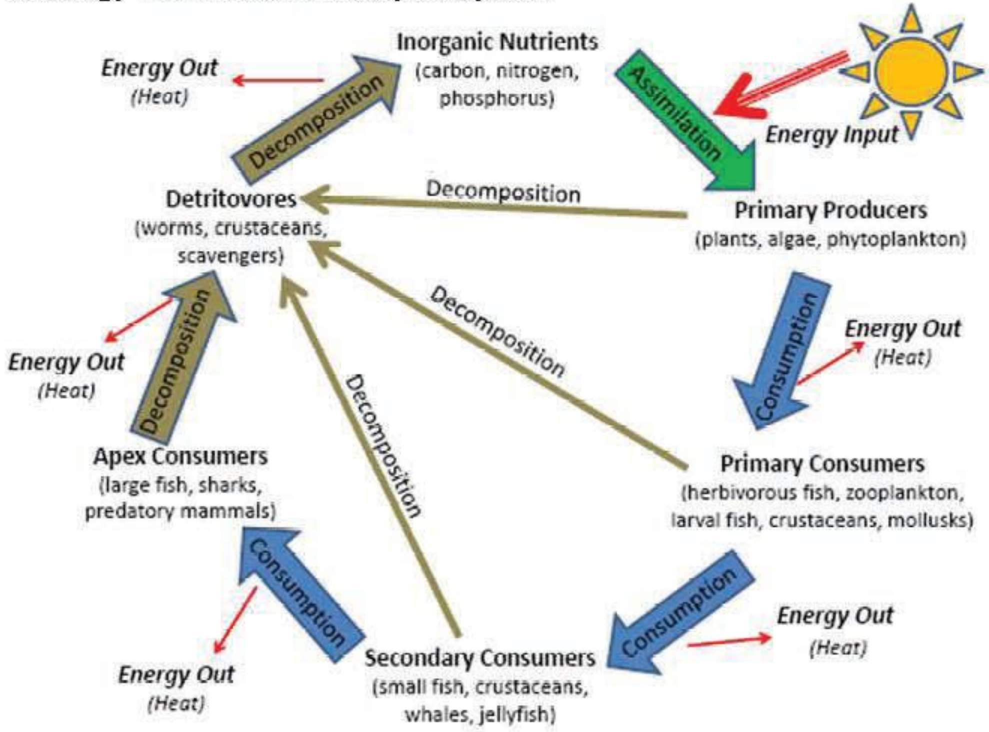
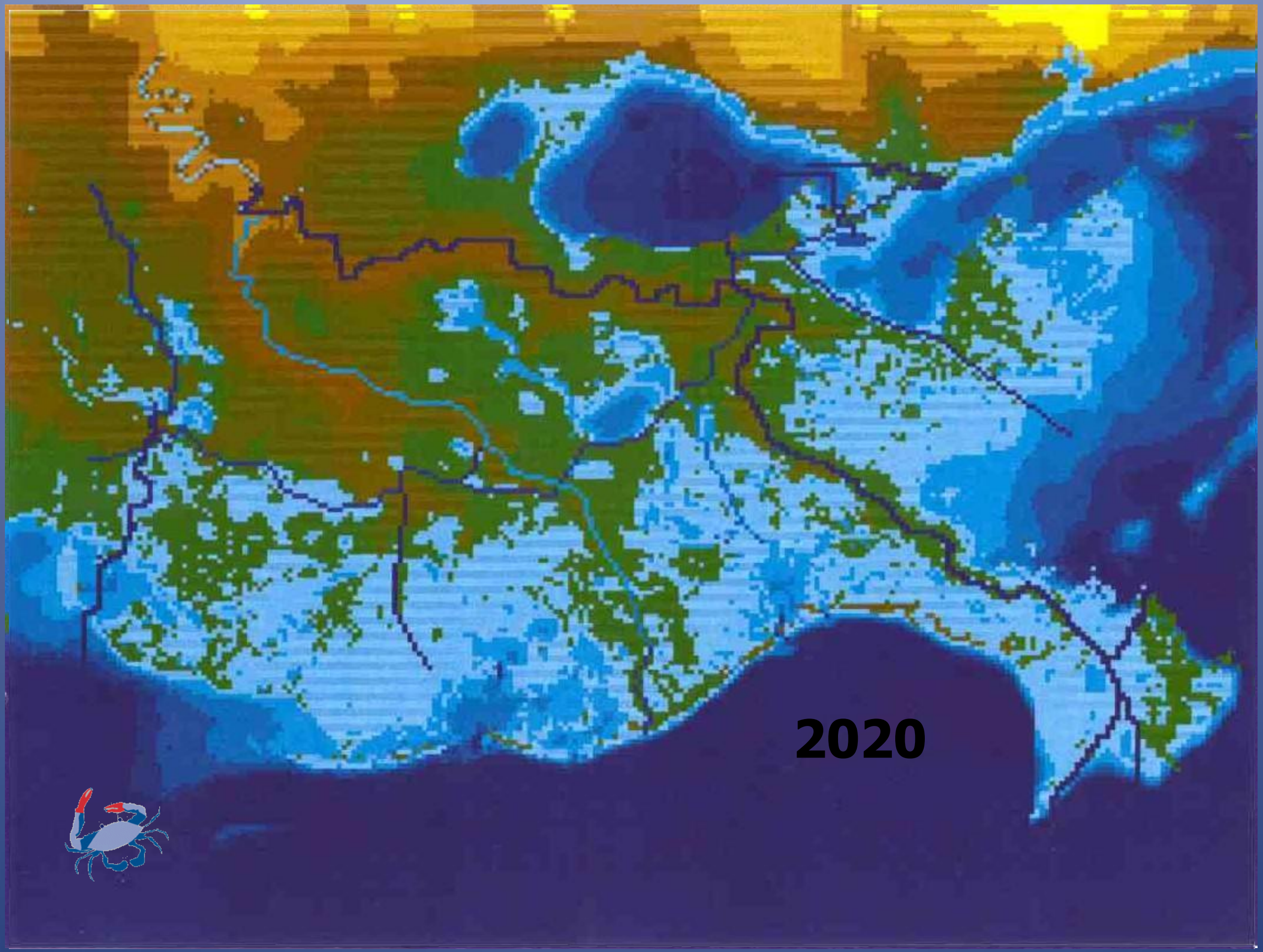


Figure 1. Aquatic ecosystem nutrient cycle and energy flow.

This figure illustrates the recycling of finite nutrients through the processes of assimilation, consumption, and decomposition. The recycling process is fueled by a continuous external energy supply (the sun), which is harnessed by autotrophs (those organisms that can derive energy from inorganic sources). These autotrophic primary producers are the basis of every food web, because the heterotrophs (those organisms that must derive energy from organic sources) rely on food sources as fuel. The by-product of feeding and decomposition is heat loss, thus illustrating the flow of energy into and out of every ecosystem.



Past and Projected Wetland Loss in Coastal Louisiana (1839 to 2020)



100+ Years of Land Change for Southeast Coastal Louisiana

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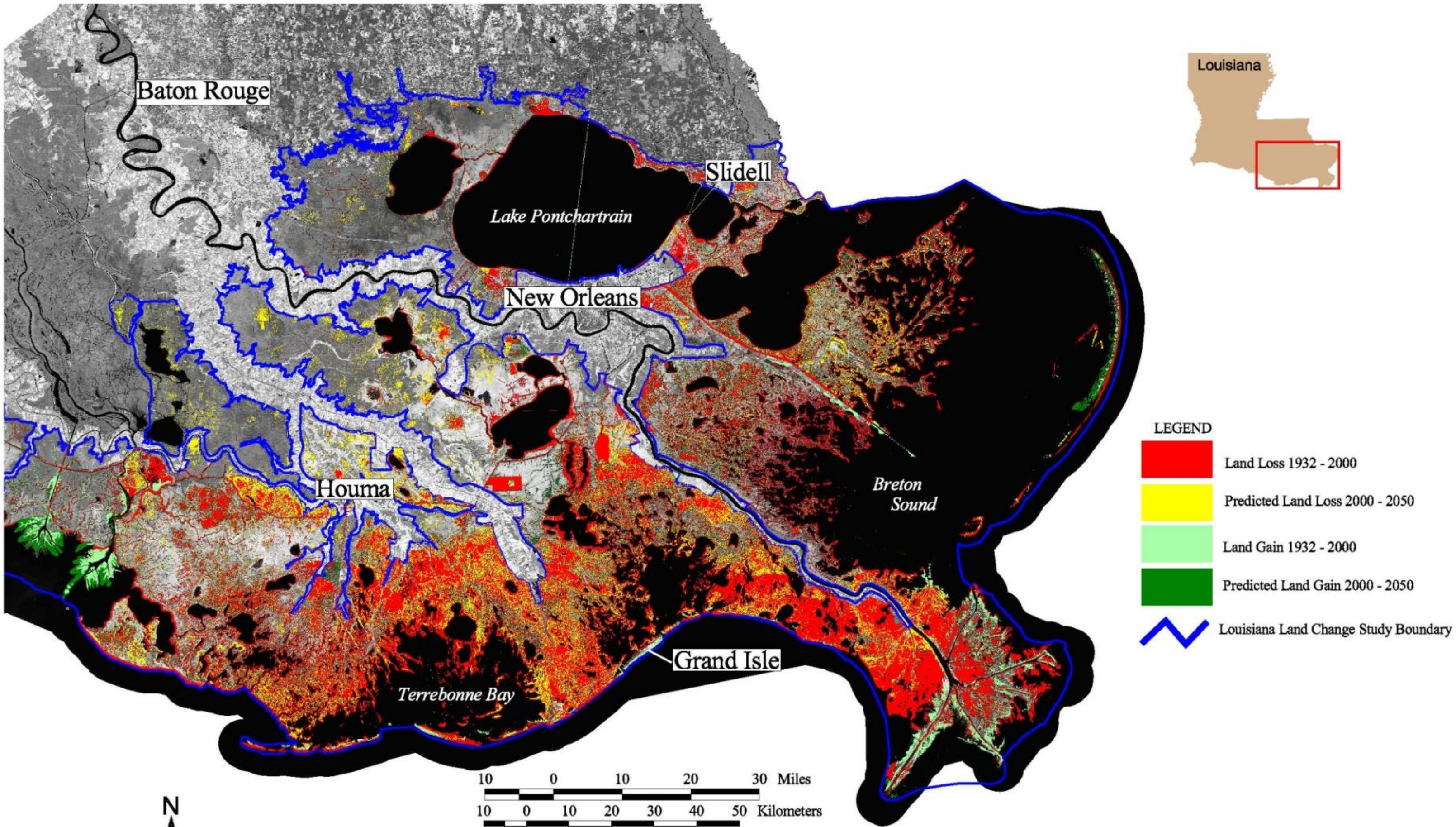


SUMMARY

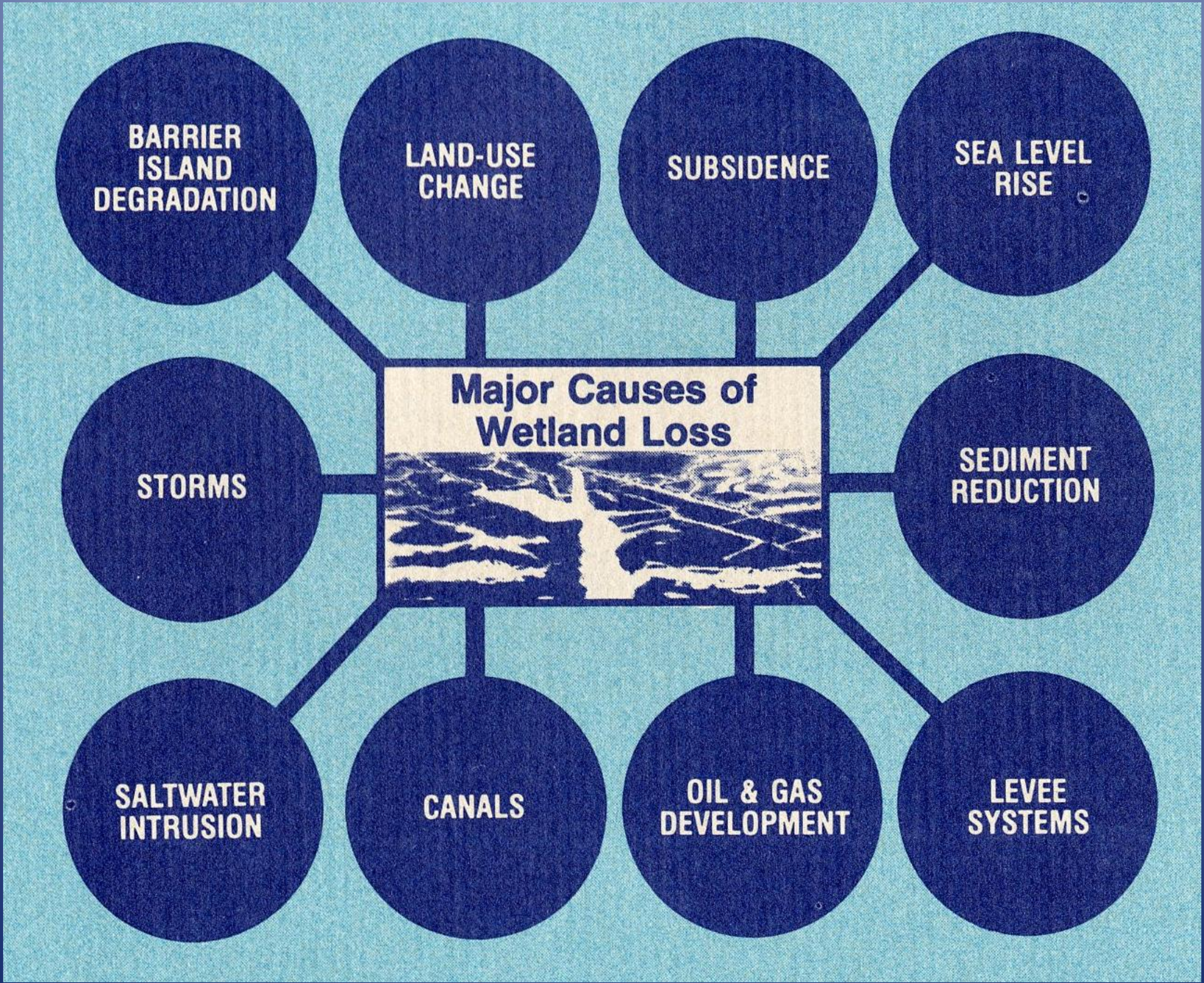
Coastal Louisiana has lost an average of 34 square miles of land, primarily marsh, per year for the last 50 years. From 1932 to 2000, coastal Louisiana has lost 1,900 square miles of land, roughly an area the size of the state of Delaware. If nothing is done to stop this land loss, Louisiana could potentially lose approximately 700 square miles of land, or about equal to the size of the greater Washington D.C.-Baltimore area, in the next 50 years. Further, Louisiana accounted for an estimated 90 percent of the coastal marsh loss in the lower 48 states during the 1990s. The area shown on this map represents over 75 percent of the total land loss for coastal Louisiana.

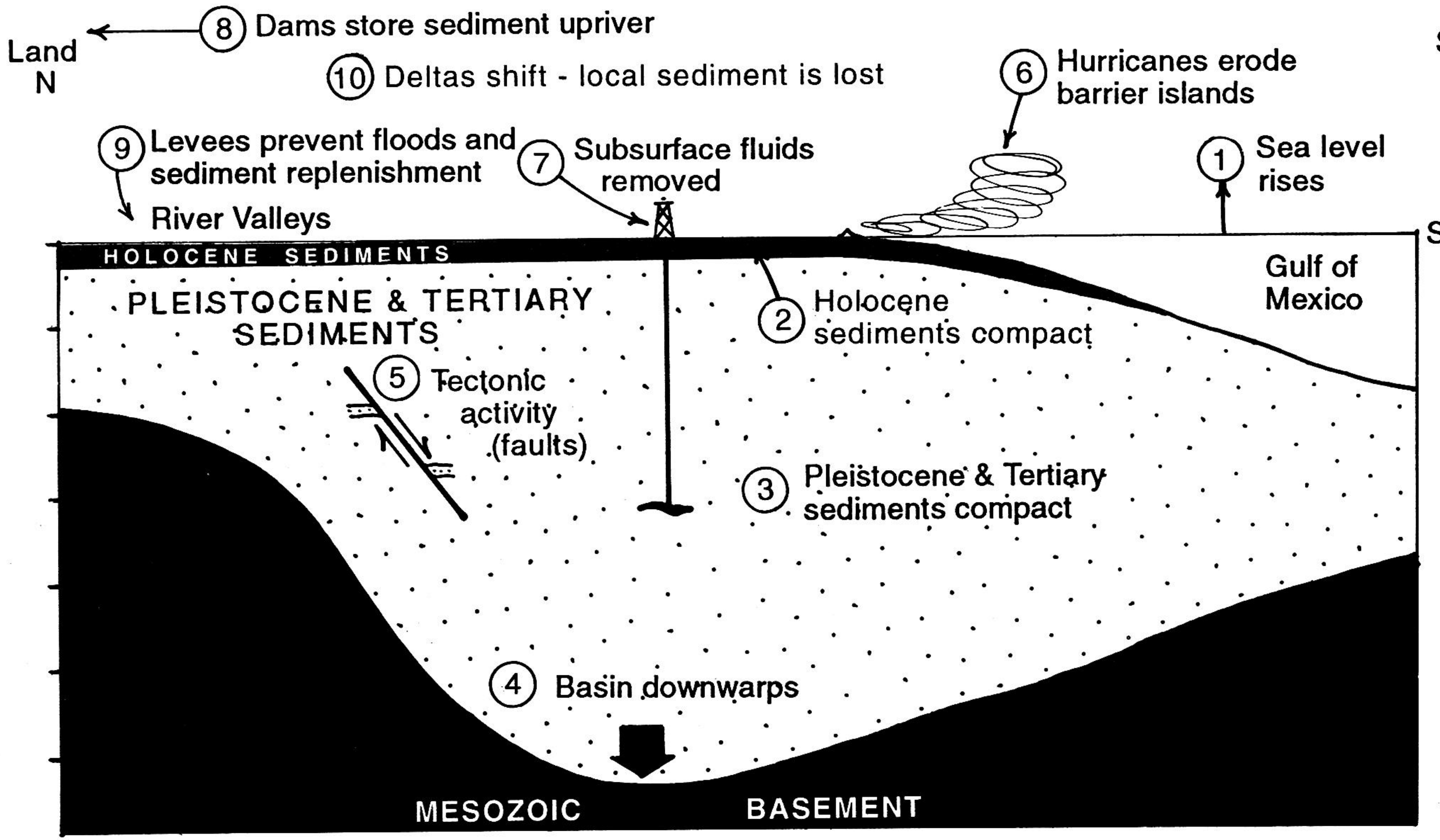
Backdrop is 2000 TM panchromatic band.

Prepared By:
U.S. Geological Survey
National Wetlands Research Center
Lafayette, LA

US Army Corps of Engineers

Map ID: USGS-NWRC 2003-02-0373


Major Causes of Wetland Loss
BARRIER ISLAND DEGRADATION
LAND-USE CHANGE
SUBSIDENCE
SEA LEVEL RISE
STORMS
SEDIMENT REDUCTION
SALTWATER INTRUSION
CANALS
OIL & GAS DEVELOPMENT
LEVEE SYSTEMS



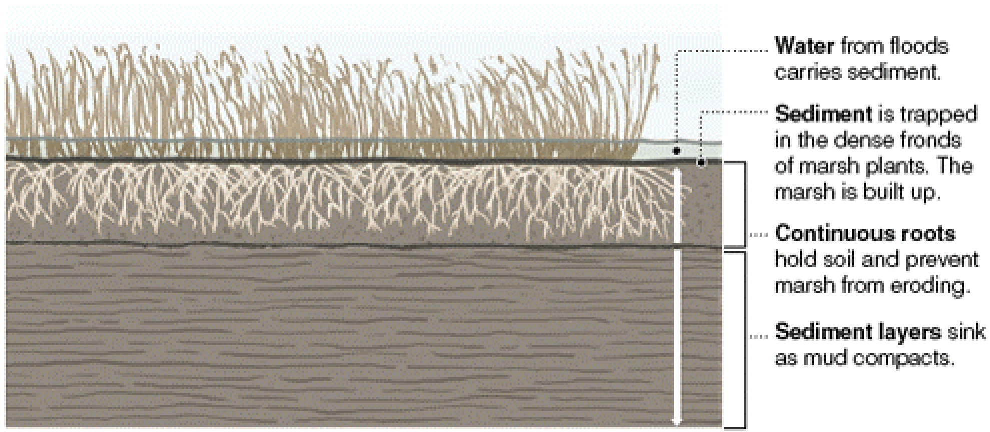
Multiple factors, both natural and man-made, contribute to wetland loss in Louisiana. Principal natural factors are subsidence and loss of sediment from delta shifts. Chief human factors are levees and dams. —Davis, 1990

When Marshes Disintegrate

Wetlands in Louisiana were already ailing before Hurricane Katrina came ashore in August. Scientists are trying to determine if the damage can be reversed.

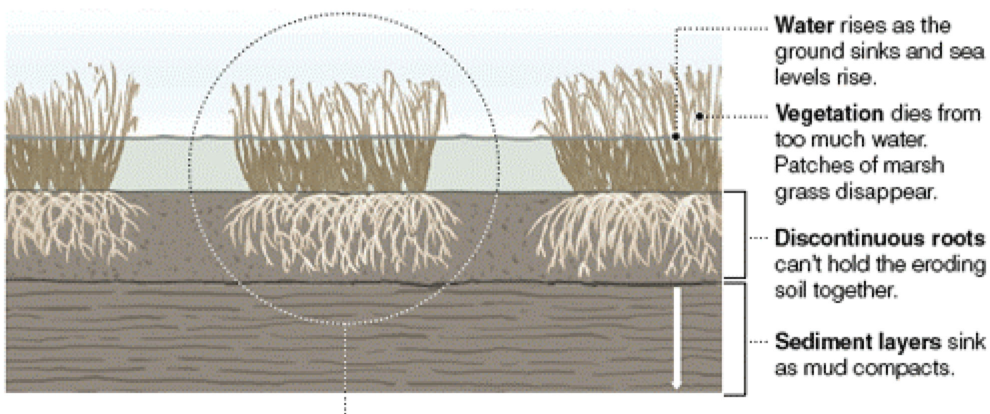
HEALTHY MARSH

The marshes were built with sediment carried by floodwaters. Over time that sediment compacted and sank, but new sediment flooded in to replace it.



UNHEALTHY MARSH

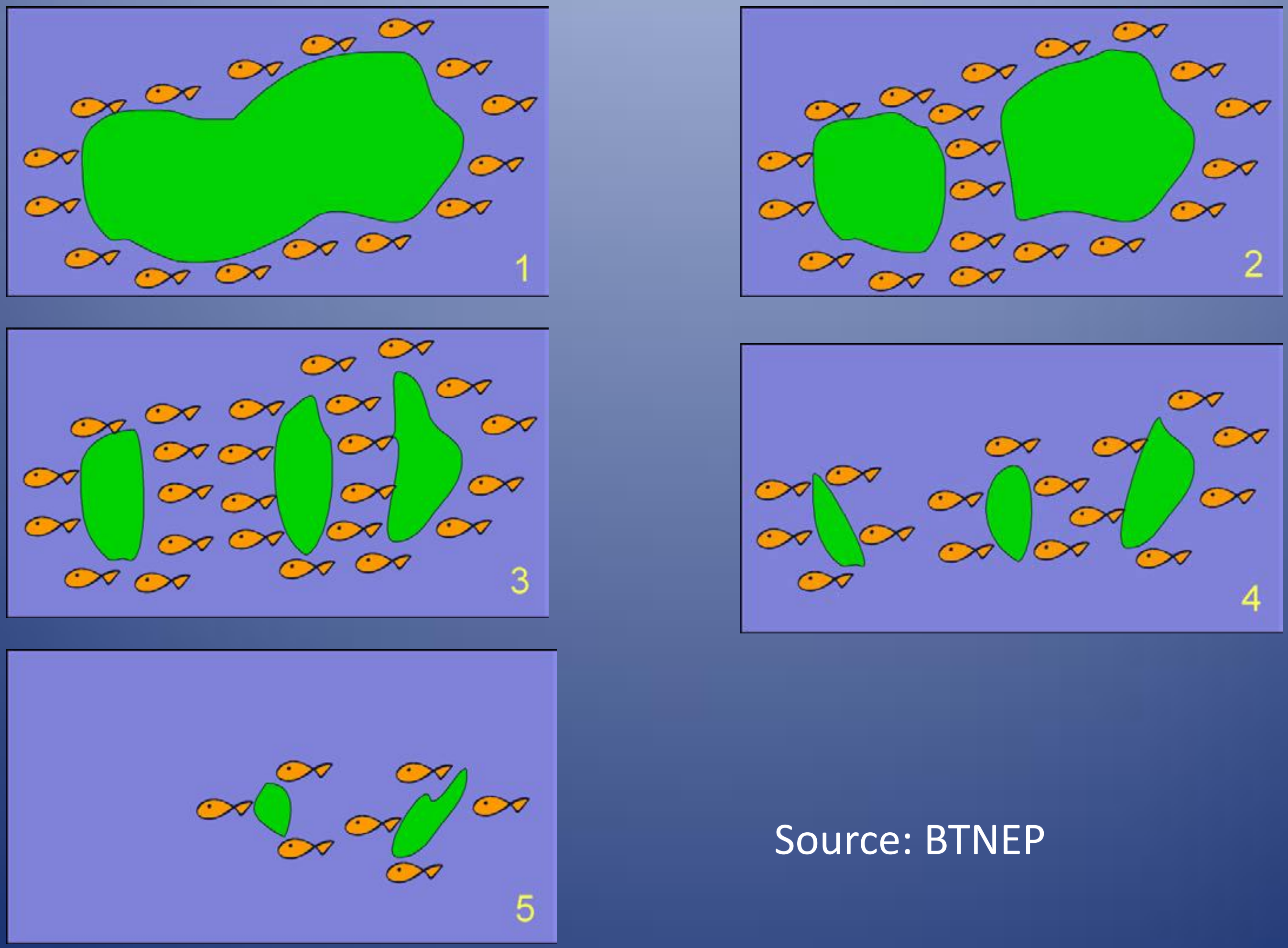
Once levees were built along waterways, sediment no longer flowed into the marshes. Deprived of new sediment, the marshes are disappearing.



When storms come through, remaining sections of plant life break off as clumps called marsh balls.

Source: Shea Penland, University of New Orleans

The "Edge Effect"
Wetland Loss = Fisheries Loss



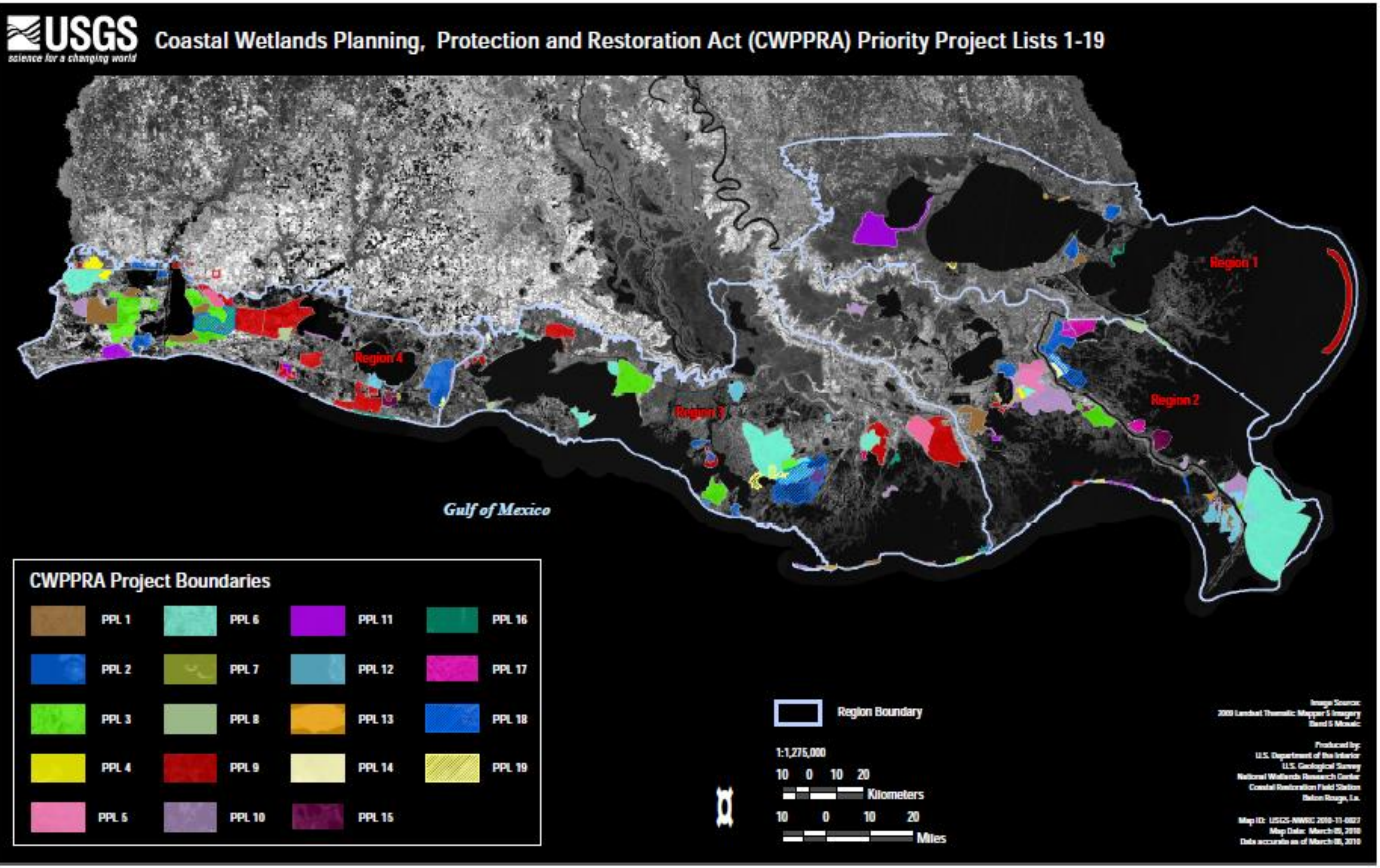
Source: BTNEP

The Stats

- >2000 square miles lost 1932 – present
- Current loss rate – approx. 20 square miles/yr.
- Pre Katrina estimate of cost to rebuild: 14 billion
- Katrina/ Rita loss: 217 square miles
- Cost multiplied – now up to (??) Billion
- Several funding sources now exist: CWPPRA, LCA, CIAP

Restoration $$ Stats

- CWPPRA since 1990: 50 Million/yr – 150+ active (small) projects designed to rebuild land
- CIAP – Coastal Impact Assessment program $250 million/yr thru 2010.
- After 2010 –Up to 200M per year after 2017 (?)
- State plan budget for 2011: $600 Million for coastal projects – not just rebuilding wetlands.
- **LCA – White House budget (Feb 2010) released $35.6 Million for larger projects. Hailed as Milestone for LA – but less than Everglades and Great Lakes……**


USGS
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Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) Priority Project Lists 1-19
Region 1
Region 2
Region 3
Region 4
Gulf of Mexico
CWPPRA Project Boundaries
PPL 1
PPL 2
PPL 3
PPL 4
PPL 5
PPL 6
PPL 7
PPL 8
PPL 9
PPL 10
PPL 11
PPL 12
PPL 13
PPL 14
PPL 15
PPL 16
PPL 17
PPL 18
PPL 19
Region Boundary
1:1,275,000
10 0 10 20
Kilometers
10 0 10 20
Miles
Image Source:
Produced by:
U.S. Department of the Interior
U.S. Geological Survey
National Wetlands Research Center
Coastal Restoration Field Station
Baton Rouge, La.

Strategies from the State Master Plan

- **Land building diversions – Very large diversions (non exist yet)**
- **Land sustaining diversions – Examples: Caernarvon and Davis Pond**
- **Marsh restoration with dredged material and sediment slurry**
- **Navigation channels – existing channels used to conduct sediment/ fresh water**

Strategies from the State Master Plan

- Barrier shoreline restoration
- Ridge habitat restoration
- Shoreline stabilization
- Closure of the Mississippi River Gulf Outlet

Restoration Types

- Freshwater diversion – or river diversions – divert water and sediment to restore marsh.
- Hydrologic Restoration – restoring the natural water flow patterns.
- Sediment Trapping – Terraces and Christmas tree fences
- Marsh Creation – using dredged sediment (beneficial use of dredged material).
- Barrier Island Sediment Restoration.
- Sediment slurry pipeline delivery – The method most favored today- **especially** using dredged material from MS River

Caernarvon Miss. River Diversion Structure

River Diversions:

- Restore Deteriorated Wetlands by Delivering Freshwater, Nutrients, and Sediment
- Freshwater - Combats Saltwater Intrusion
- Sediment - Offsets Subsidence
- Nutrients - Promotes the Growth of Submergent and Emergent Marsh

Two Types of River Diversions:

Freshwater Diversion:

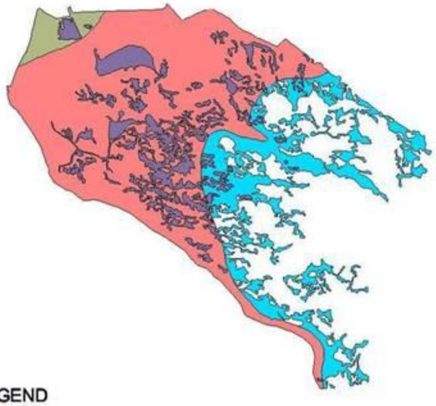
- Gates and or Siphons Used to Control Flow
- Flow is Limited to Certain Times of Year and Depends on the Flow of the River
- Caernarvon Freshwater Diversion Structure is an Example

Caernarvon Freshwater Diversion – Five culverts under river levee direct water by gravity into a canal, which conducts it away from the rive into the marsh of Breton Sound

Vegetation Types in the Caernarvon Project Area

1978 Vegetation Types

Habitat	Acres
Brackish Marsh	14154
Intermediate Marsh	749
Saline Marsh	5345
Water	3522



LEGEND
- Brackish Marshes
- Intermediate Marshes
- Saline Marshes
- Water

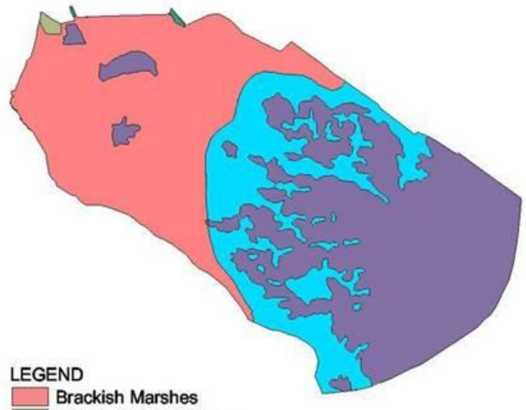
5 0 5 10 Miles

1 : 1,000,000

N

1988 Vegetation Types

Habitat	Acres
Brackish Marsh	15940
Intermediate Marsh	121
Non-Marsh	
Saline Marsh	9220
Water	18878



LEGEND
- Brackish Marshes
- Intermediate Marshes
- Non-Marsh Areas
- Saline Marshes
- Water

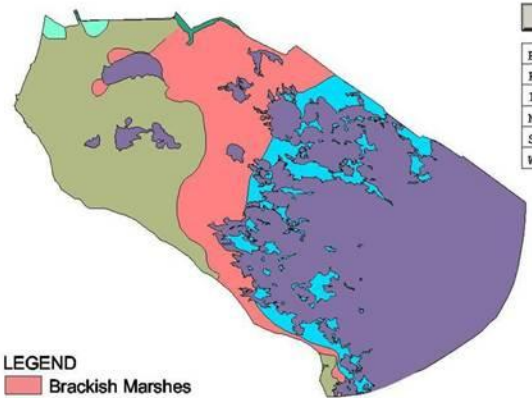
5 0 5 10 Miles

1 : 1,000,000

N

1997 Vegetation Types

Habitat	Acres
Brackish Marsh	7906
Fresh Marsh	290
Intermediate Marsh	10235
Non-Marsh	160
Saline Marsh	3558
Water	22058



LEGEND
- Brackish Marshes
- Fresh Marshes
- Intermediate Marshes
- Non-Marsh Areas
- Saline Marshes
- Water

5 0 5 10 Miles

1 : 1,000,000

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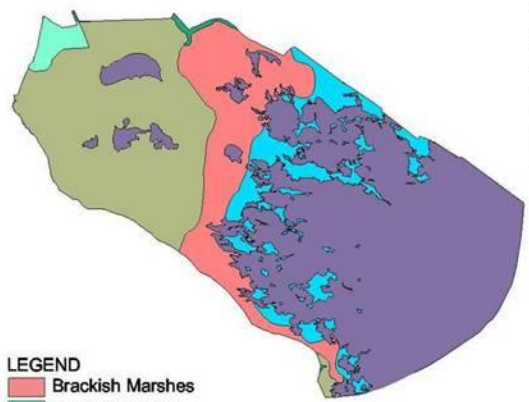
2000 Vegetation Types

Habitat	Acres
Brackish Marsh	6075
Fresh Marsh	628
Intermediate Marsh	11331
Non-Marsh	160
Saline Marsh	3955
Water	22058



LEGEND
- Brackish Marshes
- Fresh Marshes
- Intermediate Marshes
- Non-Marsh Areas
- Saline Marshes
- Water

5 0 5 10 Miles

1 : 1,000,000

N

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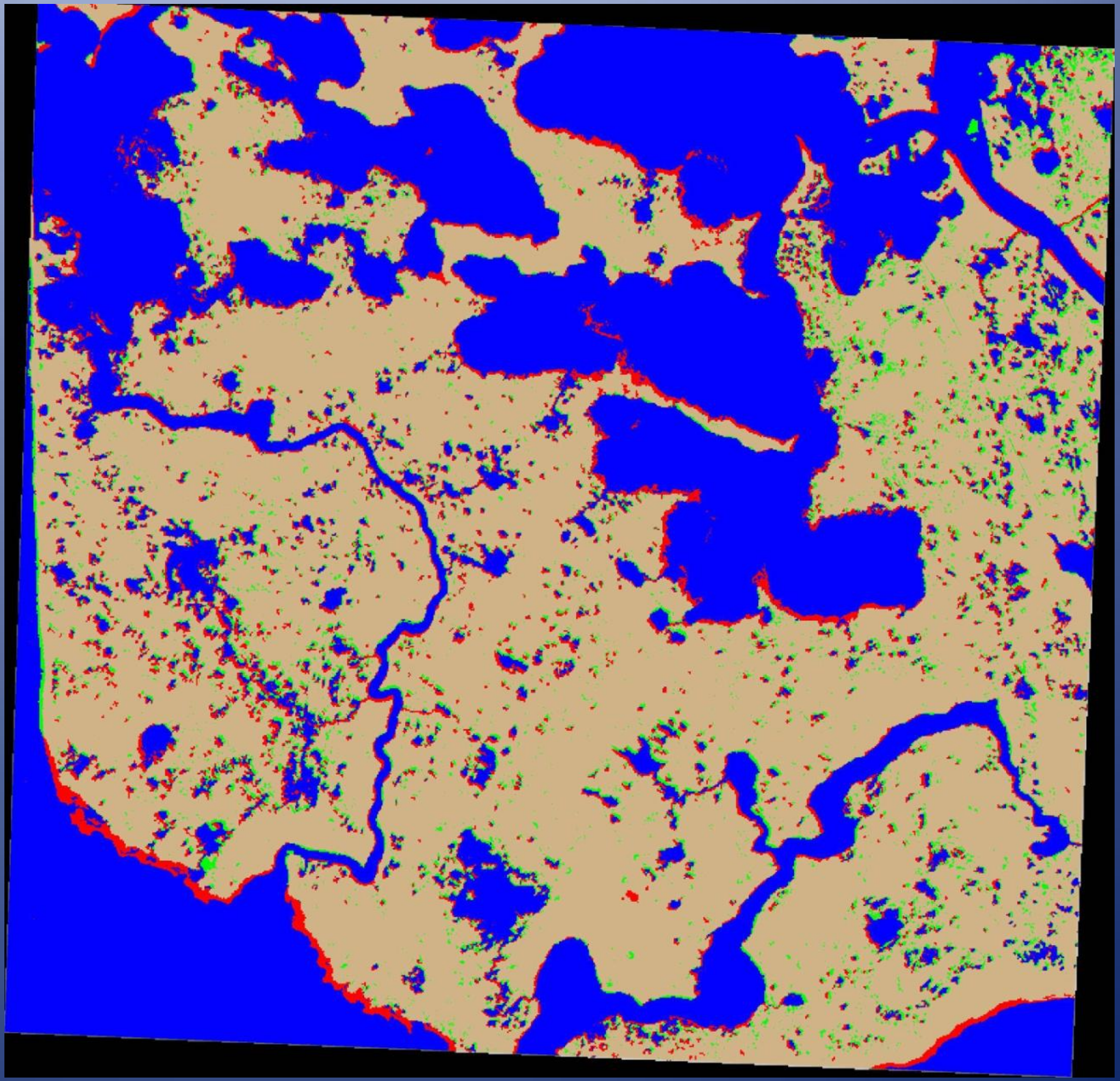
Data Source:
U.S. Geological Survey
National Wetlands Research Center
Coastal Restoration Field Station
Louisiana Department of Natural Resources
Coastal Restoration Division
Map Date: January 3,2003
Map ID: USGS-NWRC 2003-04-120

Caernarvon Outfall Land Change

Site 37
1990 – 2001
Land – Water Change

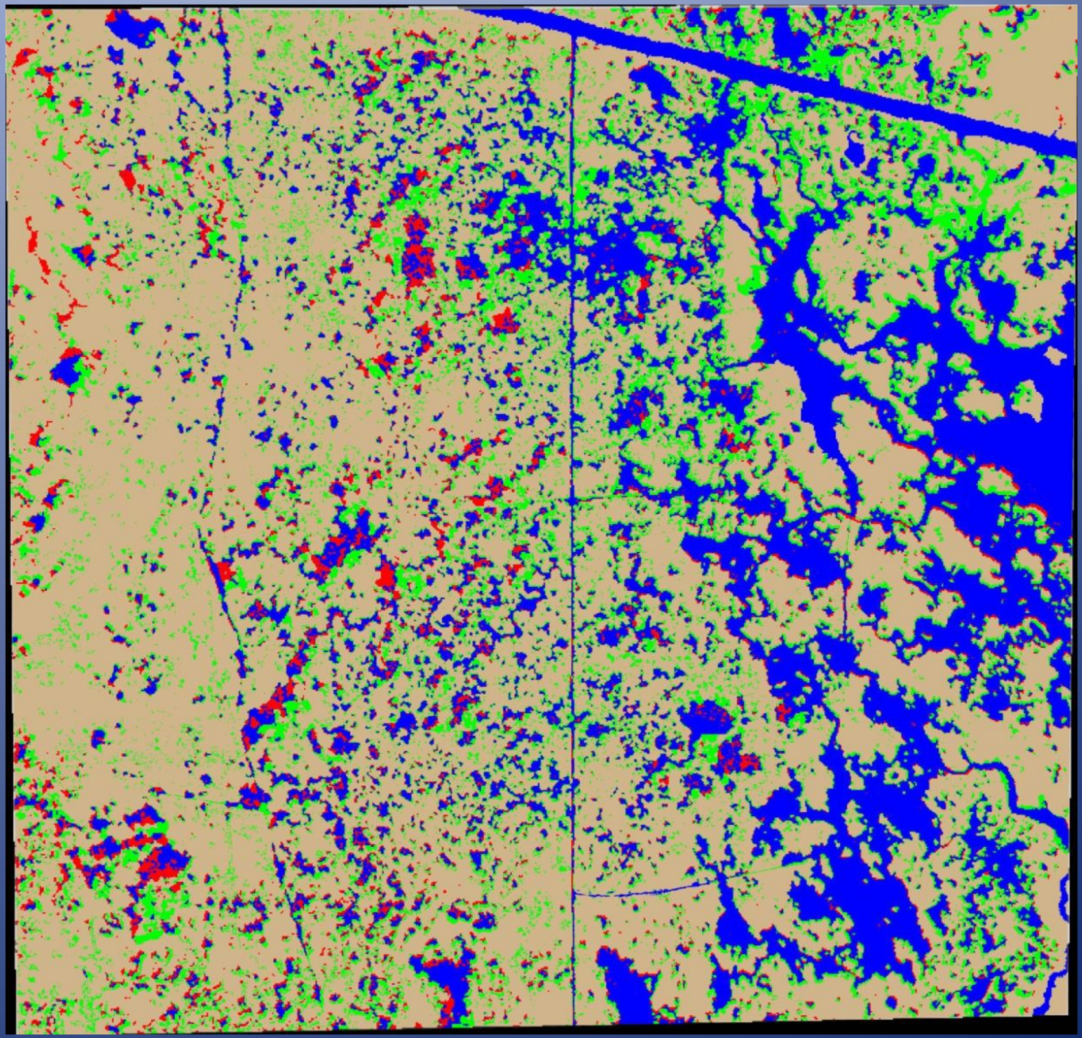


	Water	202.76
	Land	289.91
	Loss	39.98
	Gain	22.27

Figures are in acres

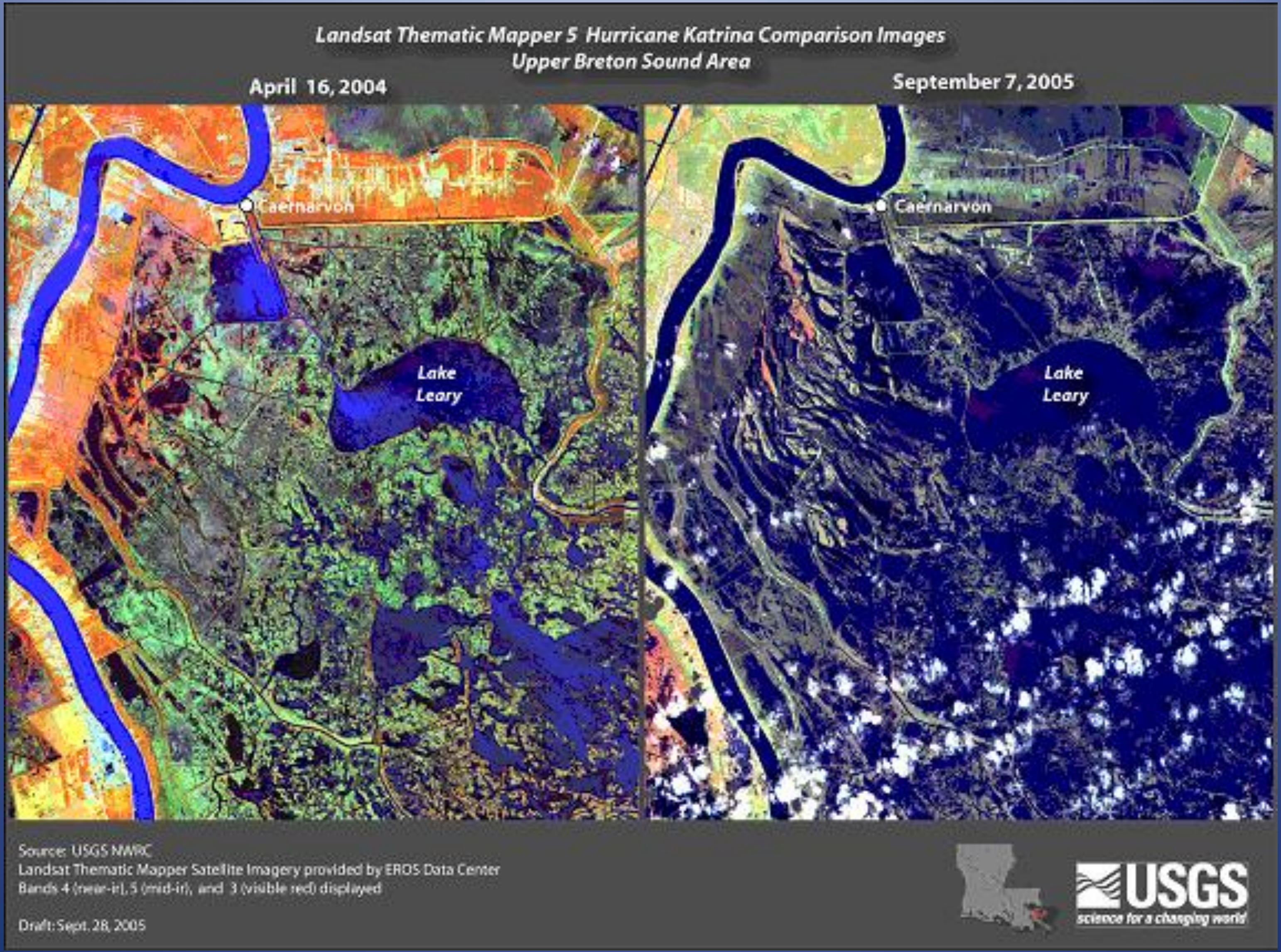
Caernarvon Outfall Land Change

Site 20
1990 – 2001
Land – Water Change



	Water	116.74
	Land	328.04
	Loss	26.22
	Gain	79.42

Figures are in acres



Landsat Thematic Mapper 5 Hurricane Katrina Comparison Images
Upper Breton Sound Area
April 16, 2004
September 7, 2005
Caernarvon
Lake Leary
Caernarvon
Lake Leary
Source: USGS NWRC
Landsat Thematic Mapper Satellite Imagery provided by EROS Data Center
Bands 4 (near-ir), 5 (mid-ir), and 3 (visible red) displayed
Draft: Sept. 28, 2005
USGS
science for a changing world

Upper Breton Sound Landsat 5 Thematic Mapper Satellite Imagery

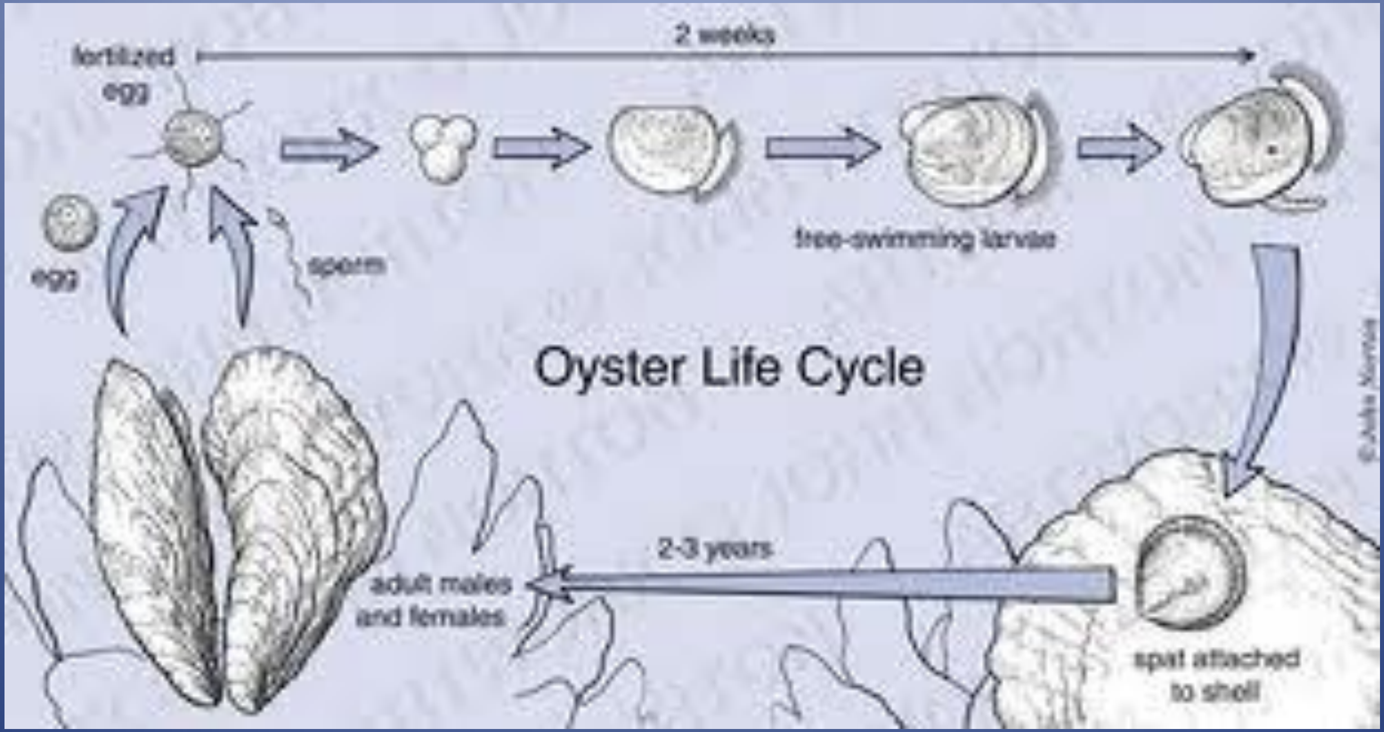
March 2, 2006

September 26, 2006

Red = growing vegetation

PB Oil Well Blow Out – Impacts on the Wetlands

Oyster (*Crassostrea virginica*) Life Cycle

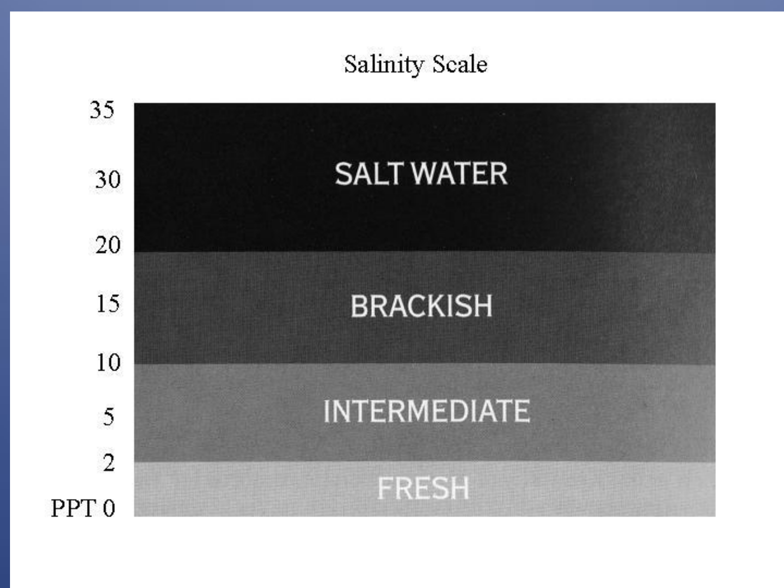


Louisiana Oyster Ecological requirements

Oysters can grow in water of between 5 – 40 ppt, but usually require a fairly narrow optimum range of salinity (14 – 28 ppt) for healthy growth. But in Louisiana a lower range (5-15 ppt is usually considered optimum.

Spat can attach and begin growing at 8 ppt or above.

Parasites (e.g., *Perkinsus marinus*, which causes and predators will impact oysters at > 5ppt and the Oyster Drill is a destructive predator at > 15 ppt. So this limited range causes oyster farmers anxiety when freshwater diversions alter the salinity in an estuary

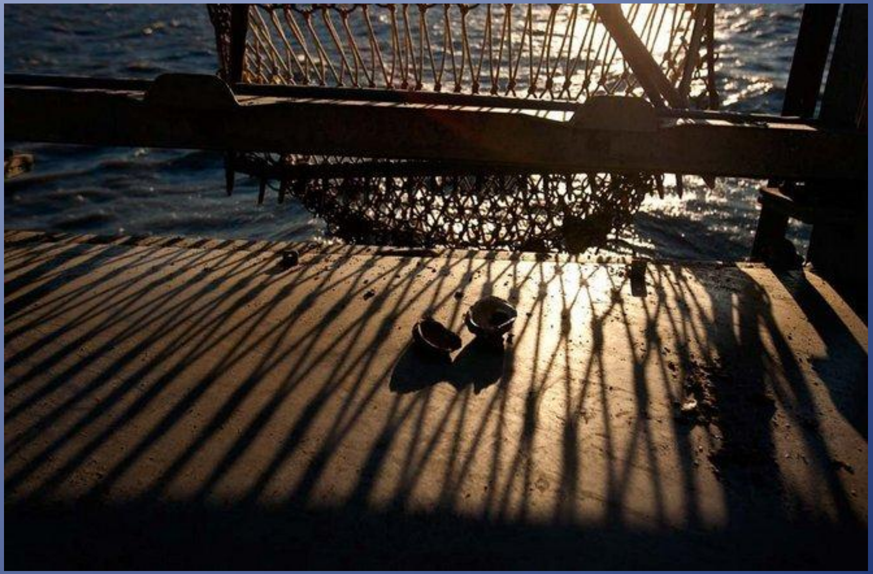


Oyster Ecology

Louisiana Oyster Harvest

Oyster Harvest Methods

Photos – David Grunfeld – Times Picayune



Impacts on Oysters in Caernarvon

The Freshwater diversion altered salinities so that oyster leases in the upper basin were destroyed, But the oyster population in the public seed grounds in the lower basin increased significantly.

During 2010 the diversions were kept running through the summer to keep the oil at bay. The results for the oyster industry so far are not good…. The oystermen are very concerned about the future.

The view from the Oyster Fisherman's Perspective

- *The oil spill disaster has raised the awareness of the importance of the Gulf Coast's natural resources, which for too long were being taken for granted. For Example, the decision to open the fresh water diversions to push the oil out was not greeted well by most oystermen. Quite frankly many of us thought that it was an attempt by the radical pro-diversion forces to use this event to see what the fresh water can do for coastal restoration. And we did see – we saw a lot of dead oysters! And when those dead oysters hit the news it brought backlash, and helped to raise questions and awareness, in the general public, and in our government. – John Tesvich – Oysterman from Plaquemines Parish and Chair of State Oyster Task Force*

BP's current response to requests for help

"BP reneges on deal to rebuild oyster beds, repair wetlands, Louisiana officials say"

The Times Picayune, Monday, February 21, 2011.

This article reports that BP had promised support for rebuilding the oyster and fishing industries, but now wants to contest that BP was responsible for damages in court.